PATENT
Attorney Docket No. 890-004.002

UNITED STATES PATENT APPLICATION

of

Ber-Fong Hwang

relating to a

FOAM SPONGE CUTTING APPARATUS WITH BOTH VERTICAL AND HORIZONTAL CUTTING DEVICES

CERTIFICATE OF MAILING UNDER 37 CFR 1.10

I hereby certify that this correspondence is being deposited with the United States Postal Service on this date, January 6, 2000, in an envelope marked as "Express Mail Post Office to Addressee," Mailing Label Number EL508859709US, addressed to the Assistant Commissioner for Patents, Washington, DC 20231.

Judith Schick

FOAM SPONGE CUTTING APPARATUS WITH BOTH VERTICAL AND HORIZONTAL CUTTING DEVICES

BACKGROUND OF THE INVENTION

The present invention relates to a foam sponge cutting apparatus with both vertical and horizontal cutting devices. A vertical cutting device and a horizontal cutting device are at the same time disposed on the blade strip frame of the cutting apparatus. The blade strips are moved up and down, while keeping in a horizontal state or moved left and right, while keeping in a vertical state. By means of the vertical and horizontal cutting devices, the foam sponge or the like can be cut into products with various irregular or curved shapes in both vertical and horizontal direction.

A conventional foam sponge cutting apparatus uses a blade which cannot be moved so that the foam sponge can be cut only along a straight line. Also, such foam sponge cutting apparatus lacks a blade deflection rectifying structure so that it is impossible to adjust the blade in time and the cutting face is often unplane. Moreover, in the case that the blade becomes rusted or obtuse, it is quite difficult to replace the blade. In addition, in cutting, when it is desired to change the position of the horizontal blade strip, it is necessary to drive a control mechanism to shift the large and heavy structure body. This wastes a great amount of power.

SUMMARY OF THE INVENTION

It is therefore a primary object of the present invention to provide a foam sponge cutting apparatus with both vertical and horizontal cutting devices, in which the horizontal blade strip can be moved up and down, while keeping in a horizontal state so that the foam sponge block can be cut into products with various irregular or curved shapes in a horizontal direction. Therefore, the cutting operation can be speeded up to save cost.

It is a further object of the present invention to provide the above foam sponge cutting apparatus in which the vertical blade strip can be moved left and right, while keeping in a vertical state so that the foam sponge block can be cut into products with various irregular or curved shapes in a vertical direction. Therefore, the cutting operation can be speeded to save cost.

It is still a further object of the present invention to provide the above foam sponge cutting apparatus in which by means of the pulley units, linear slide bars and guide rails, the movement of the blade strip can be accomplished by reversely synchronously sliding only a few elements. Therefore, it is no longer necessary to move the entire blade strip frame body and thus the power consumption is lowered.

According to the above objects, the motor drives the transmission shaft to rotate and via the thread rods, the left and right seat bodies of the blade turning unit are respectively synchronously moved along the linear slide bars and the guide rails of the linear slide bar seats. A guide wheel and a blade seat pulley respectively disposed on the two seat bodies are also synchronously moved along therewith to keep the working section of the blade strip moving up and down in a horizontal state or left and right in a vertical state. A blade strip deflection rectifying mechanism is able to automatically detect and rectify the deflection of the blade strip. The working bench is reciprocally linearly moved back and forth and the positions of the foam sponge and blade strip on the plane are adjusted by means of numeral control so as to cut the foam sponge into products with various irregular or curved shapes. A pneumatic cylinder serves to push the guide wheel to loosen the blade strip for easy replacement thereof. Therefore, the horizontal and vertical cutting operations are facilitated and stabilized and the power consumption is reduced and thus the cost is lowered.

The present invention can be best understood through the following description and accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the foam sponge cutting apparatus of the present invention;

Fig. 2 is a front assembled view of the horizontal blade strip structure of the present invention in which the cover of the blade strip frame is opened;

Fig. 3 is a side view of the working bench of the present invention;

Fig. 4 is a plane assembled view of the blade strip deflection rectifying mechanism of the present invention;

Fig. 5 is a perspective view of the blade strip deflection rectifying mechanism of the present invention;

Fig. 6 is a front assembled view of the vertical blade strip structure of the present invention in which the cover of the blade strip frame is opened;

Fig. 7 shows the application of the present invention in one state; and

Fig. 8 shows the application of the present invention in another state.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Please refer to Figs. 1 to 3. The present invention includes an apparatus body 10 and a blade strip frame 20. A working bench 11 is mounted on the apparatus body 10. A motor 13 is disposed under the working bench 11 and fitted with a toothed belt and wheel assembly 14. Two ends of each of the front and rear sections of the working bench 11 are disposed with roller shafts 12. The blade strip frame 20 is disposed with a horizontal cutting device 16. The left column of the horizontal cutting device 16 is disposed with a linear slide bar 22. A thread rod 31 is underlaid on lower side of the slide bar 22. A guide rail 21 is disposed on right side of slide bar 22 of the left column. The right column is disposed with two slide bars 22. A thread rod 31 is underlaid on lower side of each of the slide bars 22.

A blade turning unit 32 includes a left and a right blade seats. The right blade seat is hung on the slide bar 22, and the left blade seat is hung on the guide rail 21 and connected with the slide bar 22 on the left side.

Referring to Figs. 2 and 4, a blade strip deflection rectifying mechanism 50 is disposed on the blade turning unit 32. The blade holder 51 at front end is integrally connected with a first positive gear 52 for clamping a blade strip 90. Two ends of the first positive gear 52 are respectively engaged with two positive gears 53, 58. A spiral rod 54 is engaged with upper side of the second positive gear 53 and a slide block 55 is disposed on the spiral rod 54. A detector unit 56 is positioned beside the slide block 55, including an upper detector A and a lower detector B. A third positive gear 58 is disposed at the output shaft of a servomotor 57. As shown in Figs. 4 and 5, when the blade face of the blade strip 90 is turned by a certain angle, the blade holder 51 is also turned by a certain angle to make the first positive gear 52 rotate and indirectly drive the adjacent second positive gear 53 and the spiral rod 54 to rotate. Accordingly, the slide block 55 is vertically moved. When the turning angle of the blade strip 90 is responsive of the vertical moving height of the slide block and exceeds the allowed limit of the upper detector A or lower detector B, the detector unit 56 will detect this and immediately activate the servo motor 57 to operate forward or backward in time for driving the third positive gear 58 to rotate and drive the first positive gear 52 to rotate. Accordingly, the blade holder 51 can carry the blade strip 90 and rectify the deflection to a correct angle. Therefore, the detector unit is a safety device for automatically sensing and automatically rectifying the deflection.

Referring to Fig. 2, a guide wheel unit 40 includes a driving wheel 41, a pulley 43 and four guide wheels 44, 45, 46, 47. The driving wheel 41 is mounted on the lower beam of the blade strip frame 20 and connected with an output shaft of a motor. The blade seat pulley 43 is disposed on left side of the left blade seat of the blade turning unit 32 and positioned on the slide bar 22 and meshes with the thread rod 31 thereunder. The first and second guide wheels 44, 45 are mounted at two ends of the upper beam. The upper edges of the two wheels are adjacent to the tangential position. The third guide wheel 46 has a smaller diameter and is disposed on upper side of the driving wheel 41. The fourth guide wheel 47 is disposed on the upper side of the slide bar 22 of the right column and meshes with the thread rod 31 thereunder. A pneumatic cylinder 48 is vertically disposed on lower side of the second guide

wheel 45 and coupled therewith.

A blade strip 90 is wound over the driving wheel 41 and pulled upward to the second guide wheel 45. Then the blade strip 90 is tangentially pulled to the first guide wheel 44 and further pulled downward to the left blade seat pulley 43. Then the blade strip 90 horizontally passes through the left and right blade seats and then pulled to the fourth guide wheel 47 and then ~~downward pulled~~ pulled downward to the third guide wheel 46. Finally, the blade strip is pulled back to the driving wheel 41 to form a circularly winding space. The blade strip 90 includes a horizontal working section X and other sections forming the circularly winding space.

The blade turning unit movement control mechanism 93 includes a motor 23, the output shaft end of which, via a toothed belt 25 and a toothed pulley 26, is coupled with a transmission shaft 24. The left and right ends of the transmission shaft 24 are respectively vertically connected with the slide bars 22 and mesh with the thread rods 31 thereunder.

The present invention is characterized in that when the motor 23 outputs rotational power, the toothed belt 25 and the toothed pulley 26 are fitted with each other to drive the transmission shaft 24 to rotate. By means of the thread rods 31 under the respective linear slide bars 22, the left and right seat bodies 33 of the blade turning unit 32 are respectively reversely and synchronously moved along the slide bar 22 and the guide rail 21. The fourth guide wheel 47 and the blade seat pulley 43 are also guided by the thread rods 31 and synchronously reversely moved along therewith to keep the working section X of the blade strip 90 moving ~~upper~~ and down in a horizontal state.

Sub C7

When the motor drives the driving wheel 41 to rotate, the blade strip 90 ~~is~~ revolves continuously ~~revolved~~ by means of the transmission of a guide wheel unit 40 so as to provide a cutting effect on the working bench 11.

Sub C8

The pneumatic cylinder 48 pushes and displaces the second guide wheel 45 to

change the circularly close winding space of the blade strip so as to loosen the blade strip 90 for easy replacement thereof.

In addition to the above horizontal cutting device 16, the other side of the blade strip frame 20 can be disposed with a vertical cutting device 17. The components of the vertical cutting device 17 are similar to those of the horizontal cutting device, while the guide wheel unit is installed in an altered direction. Therefore, one single cutting apparatus can provide both vertical and horizontal cutting functions.

Referring to Fig. 6, the components of the guide wheel unit 40' of the vertical cutting device 17 are identical to those of the aforesaid guide wheel unit 40. As shown in Fig. 2, the entire structure of the vertical cutting device is alternatively arranged in a vertical state, in which the blade strip 90' is vertically positioned on the apparatus body 10, including a working section Y and other sections forming the circularly winding space. The blade turning unit 32', the blade strip deflection rectifying mechanism 50' and the blade turning unit movement control mechanism 93' of the vertical cutting device are also identical to those of the horizontal cutting device.

Referring to Fig. 7, ~~in use for horizontally cutting operation,~~ the foam sponge 80 is placed on the working bench 11 and then the horizontal cutting device 16 is activated. The working bench is reciprocally linearly moved back and forth so as to cut the foam sponge along various irregular or curved cutting line 81 in a horizontal direction. The travel of the blade strip 90 depends on the change of the position of the wheels of the guide wheel unit 40, whereby the driving power consumption is reduced so that the present invention can be easily and conveniently operated and is able to achieve a stable cutting effect. Therefore, the power consumption is reduced and the cost is lowered.

Referring to Fig. 8, ~~in use for vertically cutting operation,~~ the foam sponge 80 is placed on the working bench 11 and then the vertical cutting device 17 is activated

to similarly cut the foam sponge along various irregular or curved cutting line in a vertical direction. Therefore, both vertical and horizontal cutting can be performed on one single working bench. This reduces the ~~room~~ occupied by the equipment and indirectly lowers the cost.

However, since the vertical and horizontal cutting devices ~~co~~-use the working bench, when using the horizontal cutting device 16, the ~~horizontal cutting device 17~~ should be shifted to the rear end of the travel to ensure safety.

According to the above arrangement, the present invention has the following advantages:

1. The blade strip can be moved up and down in a horizontal state and the working bench is able to move the work piece so that the foam sponge can be cut into products with various irregular or curved shapes in horizontal direction. Therefore, the cutting operation is facilitated and stabilized.

2. The blade strip can be moved left and right in a vertical state so that the foam sponge can be cut into products with various irregular or curved shapes in vertical direction. Therefore, the cutting operation is facilitated and stabilized.

3. By means of the pulley unit, linear slide bars and guide rails, the shifting and changing of the interval of the blade strip can be accomplished only by sliding ~~of~~ a few elements so that the power consumption is reduced and the working cost is lowered.

4. The pneumatic cylinder serves to push the guide wheel to loosen the blade strip for easy replacement thereof.

5. The guide thread rod is fitted with connecting rod bearing so that the

guide thread rod will not swing due to excessive length and the stability is enhanced.

6. One single apparatus includes both vertical and horizontal cutting devices so that the apparatus can be very conveniently used.

The above embodiment is only used to illustrate the present invention, not intended to limit the scope thereof. Many modifications of the above embodiment can be made without departing from the spirit of the present invention.